

*OAHU MUNICIPAL REFUSE DISPOSAL
ALTERNATIVES STUDY*

ANALYSIS OF ONCE-PER-WEEK
REFUSE COLLECTION

APRIL 1999

PREPARED FOR:

CITY & COUNTY OF HONOLULU
Department of Environmental Services
Refuse Division
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TABLE OF CONTENTS

	<u>Page</u>
SECTION 1 - INTRODUCTION	1-1
1.1 Project Overview	1-1
1.2 Existing System	1-2
1.2.1 General	1-2
1.2.2 Collection System	1-2
1.2.3 Diversion	1-3
1.2.4 Disposal	1-4
1.3 Existing Collection System	1-4
SECTION 2 - COST ANALYSIS	2-1
2.1 Methodology	2-1
2.1.1 Automated Collection	2-2
2.1.2 Manual Collection	2-3
2.2 Results	2-4
2.2.1 Automated Collection	2-4
2.2.2 Manual Collection	2-6
2.2.3 Savings Potential to City	2-9
SECTION 3 - OTHER CONSIDERATIONS	3-1
3.1 Health and Safety	3-2
3.2 Public Education	3-2
3.3 Other Implementation Issues	3-2
SECTION 4 - RECOMMENDATIONS	4-1
APPENDIX	

LIST OF TABLES

TABLE 1-1	Changes in Amount of Waste Disposal	1-2
TABLE 1	Refuse Collection Performance of Automated Collection Crew	2-5
TABLE 2	Refuse Collection Costs for Automated Collection Crew	2-6
TABLE 3	Refuse Collection Performance of Manual Collection Crew	2-7
TABLE 4	Refuse Collection Costs for Manual Collection Crew	2-8
TABLE 5	Comparison of Once and Twice Weekly Collection Labor and Truck Estimates With Planned Single-Family Collection Service	2-9
TABLE 6	Comparison of Once and Twice Weekly Collection Cost Estimates With Planned Single-Family Collection Service	2-10

LIST OF APPENDIX TABLES

TABLE 1	Automated Collection Coverage	A-1
TABLE 2	Automated Collection Times Without Laie	A-2
TABLE 3	Automated Refuse Collection Quantities With and Without Green Waste	A-3
TABLE 4	Current Automated Waste Collection Cost Per Crew With Twice Weekly Collection	A-4
TABLE 5	Automated Waste Collection Cost Per Crew With 50% Less Green Waste and Twice Weekly Collection	A-5
TABLE 6	Automated Waste Collection Cost Per Crew With 50% Less Green Waste and Once Weekly Collection	A-6
TABLE 7	Manual Collection Coverage	A-7
TABLE 8	Manual Collection Times	A-8
TABLE 9	Manual Refuse Collection Quantities With and Without Green Waste	A-9
TABLE 10	Current Manual Waste Collection Cost Per Crew With Twice Weekly Collection	A-10
TABLE 11	Manual Waste Collection Cost Per Crew With 50% Less Green Waste With Twice Weekly Collection	A-11
TABLE 12	Manual Waste Collection Cost Per Crew With 50% Less Green Waste With Once Weekly Collection	A-12
TABLE 13	Manual Waste Collection Cost Per Crew With 50% Less Green Waste With Once Weekly Collection and 24,000 Pounds/Day/Crew Limit	A-13

SECTION 1

INTRODUCTION

1.1 PROJECT OVERVIEW

This report was prepared for the City & County of Honolulu (City), Department of Environmental Services, Refuse Division. This evaluation was conducted as part of an overall study addressing six key areas of the City's waste collection and diversion programs. This introduction provides a summary of the solid waste system when the evaluation was conducted.

The evaluations were conducted by R. M. Towill Corporation (RMTC) in association with Solid Waste Associates (SWA), which provided project management support and prepared two evaluations. Other companies that participated in the evaluation are listed below.

The six evaluations were:

- *A Waste Composition Analysis* of the residential, commercial, and self-haul waste streams. This analysis was conducted by Cascadia Consulting Group, Inc., and Sky Valley Associates. They were assisted by SWA.
- *A Study of Managed Competition* in waste collection and transfer services. This study was prepared by HDR Engineering, Inc.
- *An Evaluation of Green Waste Collection, Processing, and Marketing* to address the infrastructure needed for expanded green waste collection. This evaluation was prepared by Total Compliance Management, Inc., in association with SWA.
- *An Evaluation of Curbside Recyclable Collection* from single-family dwellings. This evaluation, conducted by Franklin Associates, was to determine the cost of implementing a curbside program compared to the existing drop-off system.
- *An Evaluation of Emerging Waste Management Technologies* to identify those that might be appropriate for the City to investigate further. This evaluation was prepared by ATG, Inc.
- *An Evaluation of Market Subsidies for Recyclable Materials* prepared by Skumatz Economic Research Associates (SERA).

1.2 EXISTING SYSTEM

1.2.1 General

These reports are based on conditions that existed between January 1998 and September 1998. The data on the waste collection, diversion, and disposal systems were for 1997, the latest full year for which data were available. The waste composition information was taken between April 1998 and September 1998. The waste sampling schedule for the waste composition study was based on 1997 disposal amounts and vehicle counts at the facilities to be sampled. The 1997 data used to prepare the sampling program were checked against the actual disposal in 1998 to confirm that the 1997 data were representative of 1998.

While the data for 1997 were determined to be adequately representative of the 1998 disposal for waste composition sampling plan purposes, the amount of disposal at the City's disposal facilities has decreased in 1998. The amount of waste handled at the Waimanalo Gulch Landfill and at H-Power in the last two fiscal years is shown in Table 1-1, Changes in Amount of Waste Disposal. The increase at H-POWER was due to increased availability of the plant not an increase in waste generation.

**Table 1-1
Changes in Amount of Waste Disposal**

	H-POWER	Waimanalo Gulch Landfill	Total
FY 96-97	588,939	385,248	974,187
FY 97-98	639,286	278,374	917,660
Difference	9%	-28%	-6%

1.2.2 Collection System

The City & County is divided into seven collection districts. Waste from the districts is either sent through one of three transfer stations or directly to the disposal site, depending on distance from the route to the disposal point.

The Refuse Division collects waste from single-family dwellings and from some apartment buildings and commercial facilities. Waste from most commercial facilities and apartments is collected by private waste haulers.

Residential waste is collected twice per week. In areas with automated collection services, green waste is collected separately once per month in some districts. On-call green waste collection in some automated areas is provided due to the large amount of the material that is generated. In areas with manual collection, green waste is collected with the rubbish.

Both automated and manual trucks are used for waste collection. About 40 percent of the routes are automated. The Refuse Division staff anticipates converting a total of about 80 percent of the routes to automated collection over the next several years. In the automated areas, green waste is collected with manual trucks.

The City operates a system of six convenience centers where householders can drop off waste. The centers have bins designated for recycling, H-POWER, and landfill. The customer places the waste in the proper bin.

1.2.3 Diversion

The waste diversion program includes the following components:

- A drop-off system currently located at schools around the island. Materials collected include paper, plastic, aluminum cans, and glass. The drop-off system is being expanded to additional schools and some commercial facilities, such as grocery stores.
- Green waste processing is done at three locations, two private operations and one operated by the Refuse Division (located at the Kapaa Landfill). The private operations produce both mulch and compost. The finished product is marketed in retail stores and in wholesale bulk. The Refuse Division operation produces mulch, which is provided free to the City parks and other departments and to the public.
- A statewide advanced disposal fee for glass provides an incentive for recycling that material. A fee of 1.5 cents is collected for each glass container entering the state. The processor is paid six cents per pound (or three cents per container) for the recycled glass.
- The Partnership for the Environment is a City supported organization comprised of representatives of companies that have extensive commercial recycling activities. The Partnership acts as an information source for expanding commercial recycling in the City.

- The City requires recycling of glass containers from bars and restaurants. It also requires office buildings greater than 20,000 square feet in size to recycle office paper, newspaper, and cardboard.
- Restaurants and other facilities that generate food waste are required to recycle that material.
- The City has a program to recycle materials from its offices.
- While not City sponsored, there are programs to recycle construction and demolition waste, tires, and appliances.

1.2.4 Disposal

The City operates two disposal facilities, and a third is privately operated. The City facilities are the Waimanalo Gulch Landfill and H-POWER. H-POWER is a waste-to-energy plant that processes over 620,000 tons of waste per year (about 2,000 tons per day) and generates electricity. The facility is a refuse derived fuel plant that recycles ferrous metals from the front end processing equipment and ferrous and non-ferrous metals from the ash.

The Waimanalo Gulch Landfill accepts non-combustible waste including the ash from H-POWER and other materials, mostly from private waste haulers and self-haulers. The public does not pay for waste disposal. Commercial customers pay \$65.75 per ton, which includes a state tax of \$0.35 per ton and a six-percent City recycling surcharge. On July 1, 1999 the fee will become \$72.25 per ton.

PVT Land Company operates the private landfill. It accepts construction and demolition materials at a tip fee of \$25 per ton.

1.3 EXISTING COLLECTION SYSTEM

The City currently has twice weekly collection of residential refuse. Approximately 170,000 households with individual collection service have refuse collection on Mondays and Thursdays, Tuesdays and Fridays, or Wednesdays and Saturdays. Twice weekly collection service is a long-established practice on Oahu.

Although a large number of Oahu residences are still served by three-person manual collection crews with rear loading packer trucks, the City is converting to automated collection. In the automated collection routes, a single driver/operator uses a mechanical arm from the truck to lift and empty 96-gallon household containers placed at the curb. Plans call for more than 80 percent of households to be served by automated collection within a few years. Automated collection has proved to be lower cost than manual collection in the areas of the City where it has been used.

Despite the cost savings achieved through the movement to automated collection, the City is examining ways to lower its solid waste management costs further. (The City is also reviewing other programs that could impact collection costs, such as curbside recyclables collection and curbside green waste collection.) One measure that could achieve further savings is a change from twice-per-week to once-per-week collection of residential refuse. The results from an evaluation of converting to once-per-week residential refuse collection in Honolulu are presented in this report. Major emphasis is placed on the cost implications although other considerations, including health and safety, labor requirements, public education and scheduling, are addressed, as well.

SECTION 2

COST ANALYSIS

2.1 METHODOLOGY

Profiles of existing residential collection were developed initially for both the automated and manual collection routes. Data were assimilated on the following for each of the seven collection districts:

- number of routes and households served;
- off-route and on-route collection times for both first and second day collections;
- quantities collected per route and per household for both first and second day collections;
- labor, trucks and household containers used.

The data on routes and households were for 1996. The collection times were based on average hours worked by crews in 1997, and the quantities collected were route averages from 1997. The size of the routes (i.e., households served) were essentially the same in 1997 as in 1996 based on discussions and data from the City.

Weighted averages of the collection system data for the seven collection districts were determined and used in the cost analysis to represent typical automated and manual collection routes on Oahu.¹ Collection cost estimates were then developed to reflect these typical (or average) collection routes.

Collection costs under current conditions were estimated initially. Reported cost data were used to develop annual cost estimates for both automated and manual collection crews. Costs were itemized for equipment (including trucks and household carts), labor (including salaries and fringe benefits), indirect costs (including administrative) and maintenance (including repairs, fuel and tires). Total annual costs per crew were estimated and translated into costs per ton and costs per household.

Collection costs were then developed for conditions reflecting reduced quantities of green waste. It was assumed that 50 percent of the green waste currently collected as refuse will be collected separately in the future. Thus, estimated collection costs for both twice-per-week and once-per-week

¹ The reported collection times for Laie automated routes were judged unreasonable and were excluded from the weighted average calculations. The on-route collection times per household shown for Laie were unrealistically low.

collection were developed to reflect this projected reduction in refuse. These cost estimates were considered to be the most appropriate for comparison purposes.

2.1.1 Automated Collection

Estimating collection costs with changing quantities of refuse requires, first, estimating the effects of the quantity changes on collection time requirements. In general, an increase or decrease in quantities set out for collection will result in a less than proportional increase or decrease in on-route collection time per household served. This is because the collection crew still travels the same distance on the route and the automated collection process still requires the same cycle time.

Estimated changes in automated on-route time per household due to changing amounts of refuse were based partly on comparisons of first and second day automated collections under current conditions. The differences in quantities and on-route times between these first and second day collections were used in estimating on-route time requirements under the proposed new conditions.

For once weekly collection, the dramatic increase in household refuse that would be set out for collection required a review of the need for household containers. Currently, very few households on automated routes have more than one 96-gallon container for refuse. However, the average *weekly* household refuse quantity that would be set out for collection on automated routes was estimated at just over 58 pounds, even after a 50 percent reduction in green waste. Collected all at once, this quantity would be over 45 percent more than the nearly 40 pounds per household average collected currently during the *first day* of twice weekly collection.²

Measurements of the distribution of household refuse quantities (excluding yard trimmings) set out for disposal in Kansas City, Missouri³ were used in estimating household container needs for once-per-week automated collection on Oahu. The Kansas City data (from 1991) showed a wide range in household refuse quantities set out for disposal. The data were extrapolated to estimate the distribution of setout weights on Oahu. Assuming that just over 80 pounds of refuse could normally be placed in one 96-gallon container, the analysis suggested the need for more than one container for about 20 percent of the automated-route households. One percent of the automated-route households

² Based on quantity data provided by the City and preliminary results from Oahu Waste Stream Composition Study.

³ Analysis of Effects of Waste Minimization Commission Proposed Programs with Volume-Based Fee System. Prepared for City of Kansas City, Missouri, by N.S. Artz & K.L. Totten, Franklin Associates, Ltd. August 1991.

were judged to need three containers. Thus, the on-route time per household for once-per-week collection was estimated based on the added impact of emptying more than one container at 20 percent of the households. The additional containers were included in the cost calculations as well.

For twice-per-week automated collection with reduced green waste, it was assumed that total daily time requirements for a collection crew should be about the same as for current conditions but more households would be collected. Since off-route time needs were expected to remain the same, the same on-route time was assumed, as well. The on-route time was, of course, the deciding factor in projecting the number of households served by an automated collection crew with twice-per-week collection.

For once-per-week automated collection with reduced green waste, three loads per day of seven tons each from a collection crew were estimated to require approximately the same total time as for first day collection under current conditions. (Off-route crew time would be higher than before, on average, while on-route time would be reduced accordingly.) This collection estimate of 21 tons per crew per day was used to determine the number of households served each day by an automated crew with once-per-week collection.

2.1.2 Manual Collection

As with automated collection, the first step in estimating costs for manual collection of different quantities of refuse was to determine the impact of quantity changes on collection times. A review of the differences in first and second day collection times for manual collection under current conditions on Oahu did not provide useful data for this determination. Although much smaller quantities were collected by crews on the second collection day (69 percent of the first day quantities), total on-route time remained about the same as for the first collection day. These data suggest that any change in household refuse quantities would have no impact on collection time, which is an unrealistic expectation. Thus, data from a recent Franklin Associates study⁴ were used in projecting changes in on-route time per household for varying household quantities set out for collection.

For twice-per-week manual collection with reduced green waste, it was assumed that total daily time requirements for a collection crew would be about the same as for current conditions but more

⁴ Solid Waste Management At The Crossroads by Franklin Associates, Ltd. December 1997.

households would be collected. Since off-route time should remain the same as before, the on-route time from before was used to estimate the number of households served.

For once-per-week manual collection with reduced green waste, two estimates of households served and quantities collected by a collection crew were developed for use in estimating costs. The first was based on the number of households that could be served by a crew during the on-route time used for first day collection under current conditions. This resulted in an estimated two loads per day totaling 13.8 tons. The second estimate assumed that the current requirement restricting manual collection crews to 24,000 pounds (12.0 tons) per day would remain. This second estimate of collection per crew results in higher costs than the first, of course, and reduces the cost advantage of once-per-week collection.

2.2 RESULTS

Results from the cost analysis of once versus twice-per-week collection of residential refuse on Oahu are presented here. As noted above, the results are for automated and manual collection routes judged as average (or typical). Although a few routes in the collection districts may have significant differences—in particular, a few manual routes—it was determined that costs estimated for average routes would still be a good indicator of savings that could be achieved with once-per-week collection.

2.2.1 Automated Collection

A performance comparison for an automated crew collecting residential refuse on Oahu is found in Table 1. Households served, quantities collected per household and route times are shown for three collection scenarios:

1. Twice-per-week collection under current conditions
2. Twice-per-week collection after a 50 percent reduction in green waste
3. Once-per-week collection after a 50 percent reduction in green waste

Twice-per-week collection with reduced green waste (Scenario 2) is shown to result in an automated crew serving over nine percent more households per day than under current conditions (Scenario 1). Once-per-week collection with reduced green waste results in fewer households served each day, but there is no need to return later in the week for a second collection. Thus, over 40 percent more households were estimated as served each week by a collection crew with once-per-week collection (Scenario 3) than with twice-per-week collection under Scenario 2. The time required each day on

a once-per-week route would be about the same as estimated on the first collection day of a twice-per-week route.

<p>Table 1 Refuse Collection Performance of Automated Collection Crew</p>						
Automated Collection Scenario	Households Served		First Day Collection		Second Day Collection	
	Per Day	Per Week	Avg Lbs. Per Hshold	Hours Per Route	Avg Lbs. Per Hshold	Hours Per Route
Twice/Week Current Conditions (1)	933	2,799	39.8	8.77	28.9	7.54
Twice/Week, Reduced Green Waste (2)	1,020	3,060	33.8	8.77	24.6	7.43
Once/Week, Reduced Green Waste (2)(3)	720	4,320	58.4	8.68	NA	NA
<p>(1) Based on data from Phase I - Managed Competition Study Draft Report and from the City. See Appendix Tables 1 and 2 for details. (2) Estimates by Franklin Associates based on collection under current conditions and reduced green waste. See Appendix Table 3 for refuse quantity estimates with and without green waste. (3) Assumes six routes per week served instead of three routes with twice weekly collection. NA - Not Applicable.</p> <p>Source: Franklin Associates</p>						

A comparison of costs for the three automated refuse collection scenarios is shown in Table 2. Twice-per-week collection with reduced green waste (Scenario 2) is shown to have higher costs per ton but lower costs per household than Scenario 1. This reflects the fact that more households can be served by a collection crew when collecting less waste per household, but conversely, the crew will collect fewer total tons. Household refuse collection costs are reduced an estimated 7.5 percent with the assumed 50 percent reduction in green waste collected as refuse.

Once-per-week refuse collection is shown to be significantly less expensive than twice-per-week collection. The Scenario 3 cost, estimated at \$4.31 per household per month, is \$1.10 per month (i.e., 20 percent) less expensive than the corresponding estimate for twice weekly collection under Scenario 2. Put another way, twice-per-week automated collection on Oahu would be expected to cost 25 percent more than once-per-week collection.

<p>Table 2 Refuse Collection Costs for Automated Collection Crew</p>					
Automated Collection Scenario	Crew Performance			Collection Costs (1)	
	Avg Tons Per Day	Households Served		Dollars Per Ton	Dollars Per Hshold Per Month
		Per Day	Per Week		
Twice/Week Current Conditions	16.0	933	2,799	39.34	5.85
Twice/Week, Reduced Green Waste	14.9	1,020	3,060	42.77	5.41
Once/Week, Reduced Green Waste	21.0	720	4,320	34.12	4.31
<p>(1) Estimates by Franklin Associates based on cost data from the City and County of Honolulu Refuse Division and Table 3-5 of the Phase I - Managed Competition Study Draft Report. See Appendix Tables 4, 5 and 6 for cost estimate details. Source: Franklin Associates</p>					

2.2.2 Manual Collection

A performance comparison for a manual crew collecting residential refuse on Oahu is found in Table 3. Households served, quantities collected per household and route times are shown for four collection scenarios:

1. Twice-per-week collection under current conditions
2. Twice-per-week collection after a 50 percent reduction in green waste
3. Once-per-week collection after a 50 percent reduction in green waste
4. Same as 3 except collection crew limit of 24,000 pounds per day is assumed

Twice-per-week collection with reduced green waste (Scenario 2) is shown to result in a manual crew serving about seven percent more households per day than under current conditions (Scenario 1). Under Scenario 3, nearly 60 percent more households were estimated as served each week by a collection crew with once-per-week collection than with twice-per-week collection under Scenario 2. The time required each day under Scenario 3 would be the same as estimated on the first collection day of a twice-per-week route. However, Scenario 3 assumes no daily limitation of 24,000 pounds collected by a three-person manual crew; this current weight limitation is assumed to remain in place for the other scenarios. Under Scenario 4, the number of households served would be less because

of the assumed daily limitation of 24,000 pounds collected by a three-person crew. The number of households served under Scenario 4 would be less than 40 percent above that with twice weekly collection under Scenario 2.

Table 3 Refuse Collection Performance of Manual Collection Crew						
Manual Collection Scenario	Households Served		First Day Collection		Second Day Collection	
	Per Day	Per Week	Avg Lbs. Per Hshold	Hours Per Route	Avg Lbs. Per Hshold	Hours Per Route
Twice/Week Current Conditions (1)	600	1,800	37.8	3.84	25.9	3.05
Twice/Week, Reduced Green Waste (2)	640	1,920	32.2	3.84	22.1	3.05
Once/Week, Reduced Green Waste, First Estimate (2)(3)	510	3,060	54.2	3.84	NA	NA
Once/Week, Reduced Green Waste, Second Estimate (3)(4)	443	2,658	54.2	3.60	NA	NA
(1) Based on data from Phase I - Managed Competition Study Draft Report and from the City. See Appendix Tables 7 and 8 for details. (2) Estimates by Franklin Associates based on collection under current conditions and reduced green waste. See Appendix Table 9 for refuse quantity estimates with and without green waste. (3) Assumes six routes per week served instead of three routes with twice weekly collection. (4) Differs from first once/week collection estimate in that current manual crew limit of 24,000 pounds per day is assumed. NA - Not Applicable. Source: Franklin Associates						

Costs for the four manual refuse collection scenarios are compared in Table 4. As with automated collection, twice weekly collection with reduced green waste decreases the cost per household, but increases per ton costs. While more households can be served by a collection crew, less waste will be collected by the crew. When collecting a week's worth of household waste in one drive-by rather than two, however, both per ton costs and household costs are decreased, as shown.

All of the manual collection costs shown in Table 4 are significantly higher than corresponding automated collection costs (Table 2). However, the estimated savings with once-per-week versus twice-per-week manual collection are also greater. If implemented, Scenario 3—at an estimated \$5.73

per household per month—would be expected to save 36 percent (over \$3.20 per month) of the cost of twice weekly collection under Scenario 2. If Scenario 4 were used, the once-per-week savings would be reduced to an estimated 26 percent, or nearly \$2.40 per household per month.

Table 4 Refuse Collection Costs for Manual Collection Crew					
Manual Collection Scenario	Crew Performance			Collection Costs (1)	
	Avg Tons Per Day	Households Served		Dollars Per Ton	Dollars Per Hshold Per Month
		Per Day	Per Week		
Twice/Week Current Conditions	9.6	600	1,800	69.19	9.55
Twice/Week, Reduced Green Waste	8.7	640	1,920	76.29	8.96
Once/Week, Reduced Green Waste, First Estimate	13.8	510	3,060	48.83	5.73
Once/Week, Reduced Green Waste, Second Estimate (2)	12.0	443	2,658	56.24	6.60
(1) Estimates by Franklin Associates based on cost data from the City and Table 3-5 and 4-5 of the Phase I - Managed Competition Study Draft Report. See Appendix Tables 10, 11, 12 and 13 for cost estimate details. (2) Differs from first once/week collection estimate in that current manual crew limit of 24,000 pounds per day is assumed. Source: Franklin Associates					

Manual collection savings with once-per-week collection are more pronounced than the corresponding automated savings. This is partly because of household container costs factored into the automated estimates. Since 20 percent of the automated households were estimated to require at least one additional 96-gallon container with once-per-week collection, this was factored into the cost estimates. No such added cost was factored into the manual collection analysis. It was assumed that the manual collection households would provide for any added container expense, if any.

The cost analysis demonstrates that manual collection costs are substantially higher than automated costs under current conditions. This also results in greater potential savings if a conversion is made to once-per-week collection.

2.2.3 Savings Potential to City

For the 174,700 single-family households on Oahu, the current plan is to provide automated refuse collection service to 144,491 households and manual collection service to the remaining 30,209 households.⁵ Under this plan, differences in labor, trucks and costs between once and twice-per-week collection service are estimated in Tables 5 and 6. The figures in these tables reflect the projected requirements and costs for refuse collection with a 50 percent reduction in green waste.

Comparisons of the need for trucks and crew labor are shown in Table 5. A need for 88 trucks and 149 crew persons is shown with twice weekly collection, compared with 63 trucks and 106 crew persons with once weekly collection—a 28 percent reduction in both. (As noted before, however, the need for 96-gallon household containers for automated service would be higher with once-per-week collection.)

Table 5 Comparison of Once and Twice Weekly Collection Labor & Truck Estimates With Planned Single-Family Collection Service (1)							
Type of Collection	Proposed Households Served (2)	Twice Weekly Collection (4)		Once Weekly Collection (4)		Once Weekly Collection Savings	
		Trucks	Crew Persons	Trucks	Crew Persons	Trucks	Crew Persons
Automated	144,491	66	83	47	59	19	24
Manual (3)	30,209	22	66	16	48	6	18
TOTALS	174,700	88	149	63	106	25	42
(1) Estimates reflect assumed 50 percent reduction in green waste collected with refuse. (2) From City and County of Honolulu Refuse Division. (3) Assumes more conservative (Scenario 4) estimate of once per week manual collection that restricts crews to 24,000 pounds per day. (4) Includes 40 percent spare trucks for both automated and manual routes. Crew persons based on assumed 40 hours per person per week and coverage for vacations, sick leave, holidays, etc. Note: Totals may not always add due to rounding. Source: Franklin Associates							

⁵ Data from City and County of Honolulu Refuse Division. October 6, 1998.

Comparisons of costs between once and twice weekly collection service are shown in Table 6. Most of the costs for both levels of service are for the proposed automated collection. A disproportionate amount of the total costs shown, however, is for manual collection, which was estimated to have higher costs per household in both cases. Total annual collection costs shown in Table 6 are about \$12.63 million for twice weekly collection and \$9.87 million for once weekly collection. Thus, an estimated annual savings of \$2.76 million—22 percent of twice weekly collection costs—could be saved by reducing collection service to once-per-week City-wide.

Table 6 Comparison of Once and Twice Weekly Collection Cost Estimates With Planned Single-Family Collection Service (1)							
Type of Collection	Proposed Households Served (2)	Twice Weekly Collection		Once Weekly Collection		Once Weekly Collection Savings	
		Dollars/Hshold/Month	Annual Costs (\$1000)	Dollars/Hshold/Month	Annual Costs (\$1000)	Dollars/Hshold/Month	Annual Costs (\$1000)
Automated	144,491	5.41	9,380	4.31	7,473	1.10	1,907
Manual (3)	30,209	8.96	3,248	6.60	2,393	2.36	856
TOTALS	174,700	6.02	12,628	4.71	9,866	1.32	2,763
(1) Estimates reflect assumed 50 percent reduction in green waste collected with refuse. (2) From City and County of Honolulu Refuse Division. (3) Assumes more conservative (Scenario 4) estimate of once per week manual collection that restricts crews to 24,000 pounds per day. Note: Totals may not always add due to rounding. Source: Franklin Associates							

SECTION 3 OTHER CONSIDERATIONS

3.1 HEALTH AND SAFETY

One concern with conversion to once-per-week collection of residential refuse is the potential for increased insects or other vectors because of the longer storage of refuse. For a three-month period from February to early May 1996, the City conducted a pilot program that included once-per-week automated collection of refuse and once-per-week automated collection of green waste. Approximately 900 households were included in the pilot program. Although a few complaints and concerns were registered by participants and warnings were issued to the City by the State Department of Health concerning the potential for an increase in the domestic fly population, the results from the program provided little evidence of increased problems.

In Hawaii, Maui has used once-per-week collection of refuse for over 20 years.⁶ Collection is manual and residents are limited to setting out six items—boxes, cans, bags, etc.—for collection. Problems, including insect problems, are reported as minimal, with perhaps the greatest concern being the restriction on the number of items that will be collected each week.

Experience in other areas of the U.S. may also be an indicator of what Honolulu could expect with once-per-week collection. In general, once-per-week collection is more common than twice-per-week and is clearly dominant in many areas. Many communities with warm and humid summer climates have transitioned to a single weekly refuse collection. Several cities in Florida already use once-per-week collection and Tallahassee, Florida is currently in the process of changing. Oklahoma City, Oklahoma is another large city with warm summers that recently transitioned to once weekly collection.

Summer temperatures and humidity levels in these cities are above those in Honolulu. While insects can be a problem in warm climates if refuse—particularly food waste—is left exposed, the proper use of containers with lids and/or closed bags seems to largely prevent the problem. Since Honolulu's climate remains comparatively warm all year, residents would need to be consistent in keeping their refuse enclosed in bags or containers with lids in order to minimize insects.

⁶ Communication with collection supervisor, Maui Department of Public Works. March, 1999.

Another consideration is the size of refuse setouts. First-hand observation on manual routes in Waianae revealed very large setouts reflecting very large (or extended family) households.⁷ Once weekly collection service in such areas may result in unsafe levels of refuse accumulation and/or illegal dumping. While this observation is not scientific, it does suggest significantly different levels of refuse generation in certain neighborhoods which the City needs to be aware of and adjust for.

In general, there does not appear to be evidence that once-per-week collection of residential refuse in the U.S. has resulted in increased levels of illegal dumping. The presence of convenience centers on Oahu should also serve to mitigate the potential for illegal dumping.

3.2 PUBLIC EDUCATION

At minimum, implementing a new refuse collection program will require sending a newsletter to each affected household explaining the program, its purpose and how to participate. It will also be useful to provide advance notice of the program through media coverage (initiated by press releases) and public service announcements. Public meetings will likely be needed to further explain the program and allow the public to ask questions. New collection schedules will need to be distributed, and it will be important to provide information (including contacts) that householders can use to resolve problems or ask questions about the program.

3.3 OTHER IMPLEMENTATION ISSUES

In addition to a public education program, transition to once-per-week refuse collection will involve the following:

- Rearranging collection routes and crews
- Reducing or reassigning collection labor and, perhaps, administrative staff
- Reducing trucks
- Increasing purchases of household containers for automated routes

As noted before, once weekly collection will dramatically change the number of households served by a collection crew, thereby requiring a complete revamping of routes. The need for both trucks and labor will be reduced an estimated 25 to 30 percent with once-per-week collection. Consistent with the conversion to automated collection, the number of manual collection packer trucks will be dramatically reduced and the purchase of new automated trucks will be decreased. The fleet of

⁷ First-hand observation of Waianae collection routes August 25, 1998.

manual trucks may be reduced through retiring older vehicles and selling those with remaining life. Labor reductions may present a greater problem, but can perhaps be accomplished through reassignments and attrition. For example, implementation of separate curbside collections of green waste and/or recyclables could absorb some, if not all, of the excess labor from reduced refuse collection needs.

SECTION 4

RECOMMENDATIONS

The results of the analysis of household refuse collection on Oahu suggest that the City would benefit by converting to once weekly collection from the current twice weekly collection. This is recommended for all the proposed automated routes and all manual routes except for those where very large family units result in much higher than average refuse quantities; an example would be certain manual route areas in the Waianae collection district. The projected savings in costs with once-per-week collection are 20 percent on automated routes and 26 percent on manual routes. On a City-wide basis, these savings would amount to 2.5 to 3.0 million dollars per year (in 1998 dollars) assuming the same levels of household refuse used in the analysis.⁸ The cost savings are expected to outweigh any harmful effects from longer household storage of refuse. Reduced truck traffic will be another benefit of once weekly collection.

Conversion to once-per-week collection of household refuse should be coordinated with the conversion to automated collection and should be tested in pilot programs. Allowance for the greater number of weekly households served per crew with once weekly collection, which can be tested in the pilot programs, will facilitate re-balancing of routes. Pilot programs will also help in determining the number of household containers that will be needed on automated routes with full implementation. The pilot programs will have the added benefit of alleviating many of the public concerns over once weekly collection.

The pilot programs should be conducted over a period of several months that includes, at least, a portion of the summer season. This will allow a better projection of the need for trucks and household containers. It will further provide for measuring the potential for increased insect problems during the warmer part of the year.

Route planning and public education programs should be undertaken during the pilot programs. This

⁸ As noted previously, the analysis assumes a 50 percent reduction in household green waste collected as refuse. The analysis does not account for further reductions in household refuse that would accompany more demanding household recycling through, for example, mandatory residential recycling or a curbside recycling program.

Route planning and public education programs should be undertaken during the pilot programs. This will allow for a more rapid conversion to once weekly collection throughout the city. It is anticipated that the conversion to once weekly collection throughout the city can be accomplished within two years.

APPENDIX

Appendix Table 1
Automated Collection Coverage (1)

Yard	Primary Trucks	No. Routes	No. Hshlds.	No. Hshlds. Per Route	First Day Collection			Second Day Collection			Total Weekly Collection	
					Ave. Pounds Per Route	Ave. Pounds Per Hshld.	Ave. Pounds Per Route	Ave. Pounds Per Hshld.	Ave. Pounds Per Route	Ave. Pounds Per Hshld.	Ave. Pounds	Per Hshld.
Honolulu	9	27	25,457	943	37,927	40.23	27,607	29.28			69.51	
Pearl City	8	24	22,226	926	35,640	38.48	26,060	28.14			66.62	
Kapaa	2	6	5,607	935	38,631	41.34	27,308	29.22			70.56	
Wahiawa	3	9	8,356	928	34,396	37.05	23,868	25.71			62.75	
Waianae	1	3	2,801	934	44,681	47.86	34,167	36.59			84.45	
Waialua												
Laie	1	3	2,712	904	38,401	42.48	29,374	32.49			74.97	
Totals	24	72	67,159	933	37,083	39.76	26,946	28.89			68.64	
Averages (weighted)						57.92		42.08			100.00	
Percent of Total Collection												

(1) Data on trucks, routes and households are for 1996, as reported in Phase I - Managed Competition Study Report; data on first and second day collections are for 1997, as provided by Honolulu Division of Refuse.

Source: Franklin Associates

Appendix Table 2
Automated Collection Times Without Laie(1)

Yard	Primary Trucks	No. Of Routes	No. Of Hshlds.	No. Of Hshlds. Per Route	First Day Collection Time Per Route						Second Day Collection Time Per Route					
					Total			Off-Route			On-Route			Total		
					Hours/ Route	Sec./ Route	Hshld.	Hours/ Route	Sec./ Route	Hshld.	Hours/ Route	Sec./ Route	Hshld.	Hours/ Route	Sec./ Route	Hshld.
Honolulu	9	27	25,457	943	8.83	33.7	33.7	2.79	10.7	6.04	23.1	7.51	28.7	2.42	9.2	5.09
Pearl City	8	24	22,226	926	9.04	35.1	35.1	3.67	14.3	5.37	20.9	7.86	30.6	3.16	12.3	4.70
Kapaa	2	6	5,607	935	7.76	29.9	29.9	1.96	7.6	5.80	22.3	6.83	26.3	1.75	6.7	5.08
Wahiawa	3	9	8,356	928	8.87	34.4	34.4	3.5	13.6	5.37	20.8	7.56	29.3	3.00	11.6	4.56
Waianae	1	3	2,801	934	7.75	29.9	29.9	3.17	12.2	4.58	17.7	6.58	25.4	2.75	10.6	3.83
Waialua																
Laie (2)	0	0	-	0	0	0.0	0.0	0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0
Totals	23	69	64,447													
Averages (weighted)				933	8.77	33.8	33.8	3.13	12.1	5.64	21.7	7.54	29.1	2.71	10.4	4.83

(1) Table composed from data contained in Phase I - Managed Competition Study Report. Data on trucks, routes and households are for 1996; collection times are for 1997.

(2) Laie data excluded based on information indicating route times as incorrect.

Source: Franklin Associates

Appendix Table 3
Automated Refuse Collection Quantities With & Without Green Waste

	<u>Collection</u> <u>Ave. Pounds</u> <u>Per Hshld.</u>	<u>Collection (1)</u> <u>Ave. Pounds</u> <u>Per Hshld.</u>	<u>Collection (1)</u> <u>Ave. Pounds</u> <u>Per Hshld.</u>
Condition I:			
Assumes All Green Waste Removed			
Collection With Green Waste	68.64	39.76	28.89
Green Waste Removed @ 30%	<u>20.59</u>		
Collection Without Green Waste	48.05	27.83	20.22
Condition II:			
Assumes 70% of Green Waste Removed			
Collection With Green Waste	68.64	39.76	28.89
Green Waste Removed @ 21%	<u>14.42</u>		
Collection With Reduced Green Waste	54.23	31.41	22.82
Condition III: (2)			
Assumes 50% of Green Waste Removed			
Collection With Green Waste	68.64	39.76	28.89
Green Waste Removed @ 15%	<u>10.30</u>		
Collection With Reduced Green Waste	58.35	33.80	24.55

(1) Collections with projected green waste reductions assumed in same proportions as currently experienced between first and second day collections. This reflects the fact that the current first and second day collection quantities are proportional to the number of days between collections.

(2) Condition III was assumed for cost analysis purposes.

Source: Franklin Associates

Appendix Table 4
Current Automated Waste Collection Cost Per Crew
With Twice Weekly Collection
(Ave. of 933 Households & 16 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--24 cubic yard automated packer (includes \$6,000 for spare parts)	216,000
Spare Trucks--assume 40% backup	86,400
96 Gallon Carts--assume 3 routes of 933 hshlds. each @ \$62/cart plus one percent more for hshlds. needing 2 carts	<u>175,273</u>
Total Equipment Capital Cost	477,673
Annual Cost Items:	
Truck Amortization--6 years life, no resale, 6% interest	61,497
Cart Amortization--10 years life, no resale, 6% interest	23,814
Direct Salaries/Wages--1.75 persons to cover 60 hours/week and allowance for leave (vacation, sick leave, holidays, etc.)	48,922
Labor Fringe Benefits--37.54% of wages	18,365
Indirect Costs (Administrative, etc.) (1)	8,317
Current Expenses (1)	450
Maintenance (Repairs, Fuel, Tires)--assumes \$25,000/vehicle	<u>35,000</u>
Total Annual Cost	196,364
Cost Per Hour--assumes 60 hours/week, 3120 hours/year	63
Cost Per Ton & Per Household Factors:	
Assume 16 tons/day X 6 days/week X 52 =	4,992 tons/year
Households served = 933/day X 3 routes =	2,799
Cost Per Ton	39.34
Cost Per Household Per Month	5.85

(1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.

Source: Franklin Associates

Appendix Table 5
Automated Waste Collection Cost Per Crew With 50% Less Green Waste
And Twice Weekly Collection
(Ave. of 1,020 Households & 14.88 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--24 cubic yard automated packer (includes \$6,000 for spare parts)	216,000
Spare Trucks--assume 40% backup	86,400
96 Gallon Carts--assume 3 routes of 1,020 hshlds. each @ \$62/cart plus one percent more for hshlds. needing 2 carts	<u>191,617</u>
Total Equipment Capital Cost	494,017
Annual Cost Items:	
Truck Amortization--6 years life, no resale, 6% interest	61,497
Cart Amortization--10 years life, no resale, 6% interest	26,035
Direct Salaries/Wages--1.75 persons to cover 60 hours/week and allowance for leave (vacation, sick leave, holidays, etc.)	48,922
Labor Fringe Benefits--37.54% of wages	18,365
Indirect Costs (Administrative, etc.) (1)	8,317
Current Expenses (1)	450
Maintenance (Repairs, Fuel, Tires)--assumes \$25,000/vehicle	<u>35,000</u>
Total Annual Cost	198,585
Cost Per Hour--assumes 60 hours/week, 3120 hours/year	64
Cost Per Ton & Per Household Factors:	
Assume 14.88 tons/day X 6 days/week X 52 =	4,643 tons/year
Households served = 1,020/day X 3 routes =	3,060
Cost Per Ton	42.77
Cost Per Household Per Month	5.41

(1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.

Source: Franklin Associates

Appendix Table 6
Automated Waste Collection Cost Per Crew With 50% Less Green Waste
And Once Weekly Collection
(Ave. of 720 Households & 21 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--24 cubic yard automated packer (includes \$6,000 for spare parts)	216,000
Spare Trucks--assume 40% backup	86,400
96 Gallon Carts--assume 6 routes of 720 hshlds. each @ \$62/cart plus 21 percent more for hshlds. needing 2 or 3 carts	<u>324,086</u>
Total Equipment Capital Cost	626,486
Annual Cost Items:	
Truck Amortization--6 years life, no resale, 6% interest	61,497
Cart Amortization--10 years life, no resale, 6% interest	44,033
Direct Salaries/Wages--1.75 persons to cover 60 hours/week and allowance for leave (vacation, sick leave, holidays, etc.)	48,922
Labor Fringe Benefits--37.54% of wages	18,365
Indirect Costs (Administrative, etc.) (1)	8,317
Current Expenses (1)	450
Maintenance (Repairs, Fuel, Tires)--assumes \$30,000/vehicle (2)	<u>42,000</u>
Total Annual Cost	223,583
Cost Per Hour--assumes 60 hours/week, 3120 hours/year	72
Cost Per Ton & Per Household Factors:	
Assume 21 tons/day X 6 days/week X 52 =	6,552 tons/year
Households served = 720/day X 6 routes =	4,320
Cost Per Ton	34.12
Cost Per Household Per Month	4.31

- (1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.
- (2) Assumes that the increase in quantity collected per crew per day will increase vehicle maintenance costs approximately 20 percent.

Source: Franklin Associates

Appendix Table 7
Manual Collection Coverage (1)

Yard	Primary Trucks	No. Routes	No. Hshlds.	No. Hshlds. Per Route	First Day Collection			Second Day Collection			Total Weekly Collection	
					Ave. Pounds Per Route	Ave. Pounds Per Route	Per Hshld.	Ave. Pounds Per Route	Ave. Pounds Per Route	Per Hshld.	Ave. Pounds Per Hshld.	Per Hshld.
Honolulu	20	60	36,000	600	22,822	38.04		15,692	26.15		64.19	
Pearl City	8	24	14,400	600	23,231	38.72		15,919	26.53		65.25	
Kapaa	13	39	23,400	600	22,776	37.96		15,244	25.41		63.37	
Wahiawa	4	12	7,200	600	19,979	33.30		14,116	23.53		56.83	
Waianae	3	9	5,400	600	21,899	36.50		15,640	26.07		62.57	
Waialua	2	6	3,600	600	24,034	40.06		16,830	28.05		68.11	
Lae	1	3	1,800	600	25,313	42.19		17,280	28.80		70.99	
Totals	51	153	91,800									
Averages (weighted)				600	22,694	37.82		15,563	25.94		63.76	
Percent of Total Collection						59.32			40.68		100.00	

(1) Data on trucks, routes and households are for 1996, as reported in Phase I - Managed Competition Study Report; data on first and second day collections are for 1997, as provided by Honolulu Division of Refuse.

Source: Franklin Associates

Appendix Table 8
Manual Collection Times (1)

Yard	Primary Trucks	No. Of Routes	No. Of Hshlds. Per Route	First Day Collection Time Per Route						Second Day Collection Time Per Route					
				Total			Off-Route			On-Route			Total		
				Hours/ Route	Sec./ Hshld.	Route Hshld.	Hours/ Route	Sec./ Hshld.	Route Hshld.	Hours/ Route	Sec./ Hshld.	Route Hshld.	Hours/ Route	Sec./ Hshld.	Route Hshld.
Honolulu	20	60	36,000	3.75	22.5	600	2.00	12.0	1.75	10.5	2.93	17.6	1.25	7.5	1.68
Pearl City	8	24	14,400	3.97	23.8	600	2.75	16.5	1.22	7.3	3.03	18.2	1.75	10.5	1.28
Kapaa	13	39	23,400	3.74	22.4	600	1.33	8.0	2.41	14.5	3.01	18.1	0.92	5.5	2.09
Wahiawa	4	12	7,200	3.54	21.2	600	2.58	15.5	0.96	5.8	2.93	17.6	1.58	9.5	1.35
Waianae	3	9	5,400	4.78	28.7	600	2.33	14.0	2.45	14.7	4.11	24.7	1.50	9.0	2.61
Waialua	2	6	3,600	3.86	23.2	600	1.33	8.0	2.53	15.2	3.24	19.4	0.92	5.5	2.32
Laie)	1	3	1,800	4.04	24.2	600	3.33	20.0	0.71	4.3	3.29	19.7	2.08	12.5	1.21
Totals	51	153	91,800												
Averages (weighted)				3.84	23.0	600	2.01	12.1	1.82	10.95	3.05	18.3	1.29	7.7	1.77

(1) Table composed from data contained in Phase I - Managed Competition Study Report. Data on trucks, routes and households are for 1996; collection times are for 1997.

Source: Franklin Associates

Appendix Table 9
Manual Refuse Collection Quantities With & Without Green Waste

	<u>Total Weekly Collection</u> Ave. Pounds Per Hshld.	<u>First Day Collection (1)</u> Ave. Pounds Per Hshld.	<u>Second Day Collection (1)</u> Ave. Pounds Per Hshld.
Condition I:			
Assumes All Green Waste Removed			
Collection With Green Waste	63.76	37.82	25.94
Green Waste Removed @ 30%	<u>19.13</u>		
Collection Without Green Waste	44.63	26.48	18.16
Condition II:			
Assumes 70% of Green Waste Removed			
Collection With Green Waste	63.76	37.82	25.94
Green Waste Removed @ 21%	<u>13.39</u>		
Collection With Reduced Green Waste	50.37	29.88	20.49
Condition III: (2)			
Assumes 50% of Green Waste Removed			
Collection With Green Waste	63.76	37.82	25.94
Green Waste Removed @ 15%	<u>9.56</u>		
Collection With Reduced Green Waste	54.20	32.15	22.05

- (1) Collections with projected green waste reductions assumed in same proportions as currently experienced between first and second day collections. This reflects the fact that the current first and second day collection quantities are nearly proportional to the number of days between collections.
- (2) Condition III was assumed for cost analysis purposes.

Source: Franklin Associates

Appendix Table 10
Current Manual Waste Collection Cost Per Crew
With Twice Weekly Collection
(Ave. of 600 Households & 9.56 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--20 cubic yard manual packer (includes \$6,000 for spare parts)	142,000
Spare Trucks--assume 40% backup	56,800
	<hr/>
Total Equipment Capital Cost	198,800
Annual Cost Items:	
Truck Amortization--8 years life, no resale, 6% interest	32,014
Direct Salaries/Wages--1.40 multiplier to cover 48 hours/week and allowance for leave (vacation, sick leave, holidays, etc.):	
Driver/Operator--one per crew times 1.40 multiplier	37,681
Collectors--two per crew times 1.40 multiplier	65,462
Labor Fringe Benefits--37.54% of wages	38,720
Indirect Costs (Administrative, etc.) (1)	17,534
Current Expenses (1)	949
	<hr/>
Maintenance (Repairs, Fuel, Tires)--assumes \$10,000/vehicle	14,000
Total Annual Cost	206,360
Cost Per Hour--assumes 48 hours/week, 2496 hours/year	83
Cost Per Ton & Per Household Factors:	
Assume 9.56 tons/day X 6 days/week X 52 =	2,983 tons/year
Households served = 600/day X 3 routes =	1,800
Cost Per Ton	69.19
Cost Per Household Per Month	9.55

(1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.

Source: Franklin Associates

Appendix Table 11
Manual Waste Collection Cost Per Crew With 50% Less Green Waste
With Twice Weekly Collection
(Ave. of 640 Households & 8.67 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--20 cubic yard manual packer (includes \$6,000 for spare parts)	142,000
Spare Trucks--assume 40% backup	56,800
	<hr/>
Total Equipment Capital Cost	198,800
Annual Cost Items:	
Truck Amortization--8 years life, no resale, 6% interest	32,014
Direct Salaries/Wages--1.40 multiplier to cover 48 hours/week and allowance for leave (vacation, sick leave, holidays, etc.):	
Driver/Operator--one per crew times 1.40 multiplier	37,681
Collectors--two per crew times 1.40 multiplier	65,462
Labor Fringe Benefits--37.54% of wages	38,720
Indirect Costs (Administrative, etc.) (1)	17,534
Current Expenses (1)	949
	<hr/>
Maintenance (Repairs, Fuel, Tires)--assumes \$10,000/vehicle	14,000
Total Annual Cost	206,360
Cost Per Hour--assumes 48 hours/week, 2496 hours/year	83
Cost Per Ton & Per Household Factors:	
Assume 8.67 tons/day X 6 days/week X 52 =	2,705 tons/year
Households served = 640/day X 3 routes =	1,920
Cost Per Ton	76.29
Cost Per Household Per Month	8.96

(1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.

Source: Franklin Associates

Appendix Table 12
Manual Waste Collection Cost Per Crew With 50% Less Green Waste
With Once Weekly Collection
(Ave. of 510 Households & 13.82 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--20 cubic yard manual packer (includes \$6,000 for spare parts)	142,000
Spare Trucks--assume 40% backup	56,800
	<hr/>
Total Equipment Capital Cost	198,800
 Annual Cost Items:	
Truck Amortization--8 years life, no resale, 6% interest	32,014
Direct Salaries/Wages--1.40 multiplier to cover 48 hours/week and allowance for leave (vacation, sick leave, holidays, etc.):	
Driver/Operator--one per crew times 1.40 multiplier	37,681
Collectors--two per crew times 1.40 multiplier	65,462
Labor Fringe Benefits--37.54% of wages	38,720
Indirect Costs (Administrative, etc.) (1)	17,534
Current Expenses (1)	949
	<hr/>
Maintenance (Repairs, Fuel, Tires)--assumes \$10,000/vehicle	18,200
Total Annual Cost	210,560
Cost Per Hour--assumes 48 hours/week, 2496 hours/year	84
 Cost Per Ton & Per Household Factors:	
Assume 13.82 tons/day X 6 days/week X 52 =	4,312 tons/year
Households served = 510/day X 6 routes =	3,060
 Cost Per Ton	 48.83
Cost Per Household Per Month	5.73

(1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.

Source: Franklin Associates

Appendix Table 13
Manual Waste Collection Cost Per Crew With 50% Less Green Waste
With Once Weekly Collection & 24,000 Pounds/Day/Crew Limit
(Ave. of 443 Households & 12 Tons/Day/Crew, 6 Days/Week)

Capital Cost Items:	Costs (in dollars)
Truck Chassis & Body--20 cubic yard manual packer (includes \$6,000 for spare parts)	142,000
Spare Trucks--assume 40% backup	56,800
	<hr/>
Total Equipment Capital Cost	198,800
 Annual Cost Items:	
Truck Amortization--8 years life, no resale, 6% interest	32,014
Direct Salaries/Wages--1.40 multiplier to cover 48 hours/week and allowance for leave (vacation, sick leave, holidays, etc.):	
Driver/Operator--one per crew times 1.40 multiplier	37,681
Collectors--two per crew times 1.40 multiplier	65,462
Labor Fringe Benefits--37.54% of wages	38,720
Indirect Costs (Administrative, etc.) (1)	17,534
Current Expenses (1)	949
	<hr/>
Maintenance (Repairs, Fuel, Tires)--assumes \$10,000/vehicle	18,200
Total Annual Cost	210,560
Cost Per Hour--assumes 48 hours/week, 2496 hours/year	84
 Cost Per Ton & Per Household Factors:	
Assume 12 tons/day X 6 days/week X 52 =	3,744 tons/year
Households served = 443/day X 6 routes =	2,658
 Cost Per Ton	 56.24
 Cost Per Household Per Month	 6.60

(1) Based on the percentage of salary and wages reflected in Table 3-5 of the Phase I - Managed Competition Study Draft Report.

Source: Franklin Associates